Technology Opportunity
Glenn Research Center • Cleveland • Ohio
Technology Transfer & Partnership Office
TOP3–00177

Skin-Modified Aerogel Monoliths

Technology

The National Aeronautics and Space Administration (NASA) seeks to transfer technology for the development and production of skin-modified aerogel monoliths. These aerogel monoliths are mechanically robust with no alteration of their bulk chemical composition and properties, which include low density, high porosity, high surface area, low dielectric constant, and low thermal conductivity.

Benefits

- New material allows wider industrial use of aerogels
- Mechanically robust, easy-to-handle monolithic aerogels
- Hydrophobic
- Simple processing

Commercial Applications

- Thermal insulation
- Acoustic insulation
- Cryogenic systems
- Laboratory dewars

Technology Description

Aerogels are the lowest-density solid materials in existence and are made up of a nanoporous network of particles. Silica aerogels are very brittle, difficult to handle, and tend to absorb moisture, making them unattractive for many practical applications. Historically, aerogels have been used in numerous space missions and other specialized environments because of their low density and high compressive strength. For example, they have been used as collectors of hypervelocity particles, and as thermal insulators in extreme environments (Mars rovers). Currently, only irregularly small aerogel beads are available commercially in bulk quantities.

Researchers at NASA Glenn Research Center (GRC) have solved two primary problems common to aerogels—brittleness and hydrophilicity—by applying a hard skin to the surface of aerogel monolithic tiles. This aerogel encapsulation allows easy handling and transportation without compromising the bulk properties of the material. The coatings are achieved by simply painting or spraying the aerogel monoliths with appropriate polymer precursors. By controlling the amount of the polymer precursor coating and curing, a hard polymer layer creates a high-strength shell without destroying or collapsing the underlying aerogel.

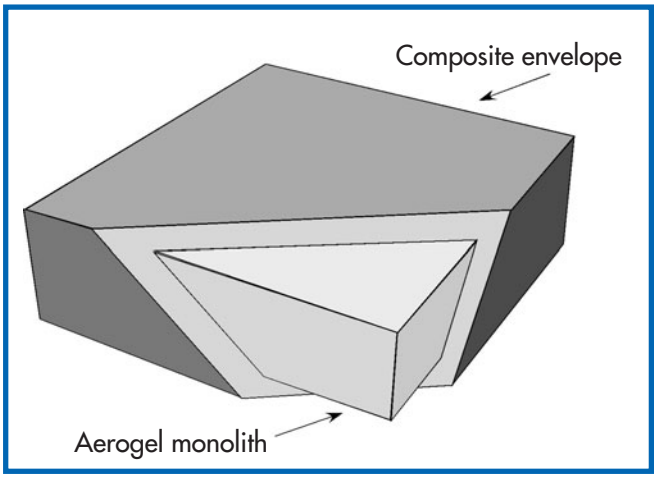

Figure 1– Aerogel monolith tiles can be coated with a thin polymer composite crust creating robust, mechanically strong, and easy-to-handle aerogels.

NASA GRC demonstrated this process using isocyanates, creating a polyurethane/polyurea-like coating, with commercial epoxy resins. High-temperature resistant protective layers can be made by using polyimide precursors or other resins and curing protocols. The resulting monolithic tiles can be easily transported to customers, where they can be laminated for thermal insulation. In addition, strengthening layers can be built on top of the foundation provided by the skin, further enhancing the overall strength, environmental stability, and durability of the underlying aerogel monolith.

Options for Commercialization

NASA Glenn Research Center is interested in working with industry and academia to further develop this material and identify new applications for skin-modified aerogel monoliths.

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References

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Key Words

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